

THE DISTRIBUTION OF THE ICHTHYOFAUNA IN THE SIMETO BASIN (SICILY)

by

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ABSTRACT. - The results obtained during fifteen years (1977-1992) about the fish fauna distribution in 48 stations of the Simeto basin are reported. We have recorded 19 species of teleosts belonging to 13 families. The comparison between the present distribution of the fish fauna and that existing in past years (Tigano, 1983) indicates that the ichthyofauna met with a remarkable alteration and a general impoverishment.

RÉSUMÉ. - Les recherches effectuées pendant quinze années (1977-1992) sur la distribution des poissons de 48 stations du bassin de la rivière Simeto ont permis de répertorier 19 espèces de téléostéens appartenant à 13 familles. La comparaison entre leur distribution actuelle et passée (Tigano, 1983) montre une altération remarquable et un appauvrissement général des peuplements.

Key-words. - Teleosts, Sicily, Simeto river, Fish distribution.

The research made on the European river ecosystems, in the last decade, shows the impact of human activities on the fluvial biocoenoses. The qualitative and quantitative data available for the ichthyofauna, within the last century, allow us to follow its alteration and to individualize the reasons for its impoverishment in most of the rivers studied (Alessio and Gandolfi, 1983; Arrignon, 1988; Philippart *et al.*, 1988).

Present knowledge about the fish populations of the Sicilian rivers is poor. The more recent data concern the ichthyofauna of a few rivers of the Simeto basin (Tigano, 1983; Tigano and Ferrito, 1986, 1988, 1991; Ferrito, 1990) and of the Salso or Southern Imera basin (Tigano and Ferrito, 1985), in central and eastern Sicily. In this work we report the results of new investigations along the course of the Simeto river and of its tributaries and we review the distribution of the ichthyofauna in the Simeto basin since 1977 up to now.

MATERIAL AND METHODS

Since 1977 up to now, we have examined 48 stations (Table I) in the Simeto basin. The stations are localized both along the course of the Simeto river and along some tributaries (Figs 1, 2). We have made 109 catches of fish in all, by netting, and we have examined a total of 413 specimens. The material studied, fixed in 10% formalin and stored in 70% ethyl alcohol, is deposited at the Department of Animal Biology of the University of Catania.

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Table I. - List of the rivers and stations examined in the Simeto basin with abbreviations of the station names and their number, UTM co-ordinates and catch dates.

River and Stations		U.T.M.	Catch date
Simeto (Si)	Si1 Ponte Bolo	VB 8287	21 Nov. 88, 18 Apr. 91
	Si2 Ponte Passo Paglia	VB 8280	12 Oct.-21 Nov. 88, 23 Aug.-22 Sep. 89, 15 Apr. 91
	Si3 Ponte Pietrerosse	VB 8076	24 Jul. 91
	Si4 Ponte dei Saraceni	VB 8273	23 Nov. 88, 13 Mar.-24 Aug. 89
	Si5 Santa Domenica	VB 8271	24 Jul. 91
	Si6 Ponte Maccarone	VB 8167	13 Oct.-23 Nov. 88, 20 Mar. 89
	Si7 Barcavocchia	VB 8366	7 May 81, 23 Nov. 88, 20 Mar. 89, 24 Jul. 91
	Si8 Ponte Pietralunga	VB 8759	18 Jan.-26 Feb. 78, 24 Nov. 88, 22 Mar. 89, 24 May 91
	Si9 Castellaccio	VB 8758	26 Feb.-21 Jul.-29 Sep. 80, 29 Apr.-28 May-2 Jul. 81, 5 Jun. 87, 4 May 88, 24 May 91
	Si10 Ponte Barca	VB 8854	27 Sep. 80, 27 May 81, 24 May 91
	Si11 Ponte Giarretta	VB 9145	16 Jan.-12 Mar.-2 Jun. 81, 22 Mar. 89, 16 May 91
	Si12 Ponte Impero	WB 0241	30 Oct. 80, 30 Nov. 81, 3 May 91
	Si13 Ponte Primosole	WB 0440	3 May 91
	Si14 Ponte Primosole	WB 0539	18 Nov. 77, 19 Dec. 88, 30 Jun.-24 Jul. 90, 3 May 91
Saracena (Sa)	Sa1 Chiusita	VB 8598	25 Aug. 89
Cuto' (Cu)	Cu1 Vitalone	VB 7791	21 Oct. 89, 22 Apr. 91
Troina di Sotto (Str)	Str1 Cugno di Carcaci	VB 7669	28 Sep. 84
Troina (Tr)	Tr1 Ponte Borgonovo	VB 6884	28 Sep. 84
	Tr2 Serravalle	VB 8284	23 Nov. 88, 20 Mar.-24 Aug. 89
Salso (Sal)	Sal1 Bivio Salso	VB 4477	10 Oct. 84, 8 Oct. 91
	Sal2 Fontana di Piazza	VB 4875	10 Oct. 84
	Sal3 Contrada Comune	VB 5869	28 Sep. 84, 8 Oct. 91
	Sal4 Santa Venera	VB 7070	28 Sep. 84
	Sal5 Contrada Miraglia	VB 7469	28 Sep. 94
	Sal6 Masseria D'Aragona	VB 8066	23 Nov. 88, 20 Mar. 89
Mandre (Ma)	Ma1 Poggio Sperone	VB 4376	10 Oct. 84, 8 Oct. 91
Ceramì (Ce)	Ce1 Contrada Manzuolo	VB 5185	29 Jul.-25 Sep. 84, 3 Jun. 86, 2 Jun. 88, 7 Oct. 91
	Ce2 Ponte di Ceramì	VB 5581	7 Oct. 91
	Ce3 Contrada Caferferi	VB 5677	7 Oct. 91
	Ce4 Monte S. Pietro	VB 5676	2 Jun. 88
	Ce5 Campograsso	VB 5573	10 Oct. 84, 20 May-5 Dec. 86, 2 Jun. 87, 17 Jun. 91
Bozzetta (Bo)	Bo1 Pirato	VB 4462	7 Jul. 92
Dittaino (Di)	Di1 Passo di Catalano	VB 4761	7 Jul. 92
	Di2 Masseria Tuttobene	VB 5059	7 Jul. 92
	Di3 Contrada Vanadia	VB 5357	7 Jul. 92
	Di4 Cuticchi	VB 5755	7 Jul. 92
	Di5 Masseria Schembari	VB 7256	7 Jul. 92
	Di6 Contrada Muglia	VB 7254	4 Jun. 90, 11 Jun. 91, 7 Jul. 92
	Di7 Masseria Stimpato	VB 8243	11 Jun. 91
	Di8 Passo Noce	VB 9140	11 Jun. 91
Gornalunga (Go)	Go1 Contrada Massineo	VB 5945	8 Jul. 92
	Go2 Masseria Cugno	VB 6543	8 Jul. 92
	Go3 Casal D'Urso	VB 7045	8 Jul. 92
	Go4 Tenutella	VB 7241	8 Jul. 92
	Go5 Gabella	VB 7643	8 Jul. 92
	Go6 Masseria Palmeri	VB 8539	8 Jul. 92
	Go7 Favotto	VB 8939	31 May 91
	Go8 Passo Martino	WB 0038	28 Jun. 81, 31 May 91, 8 Jul. 92

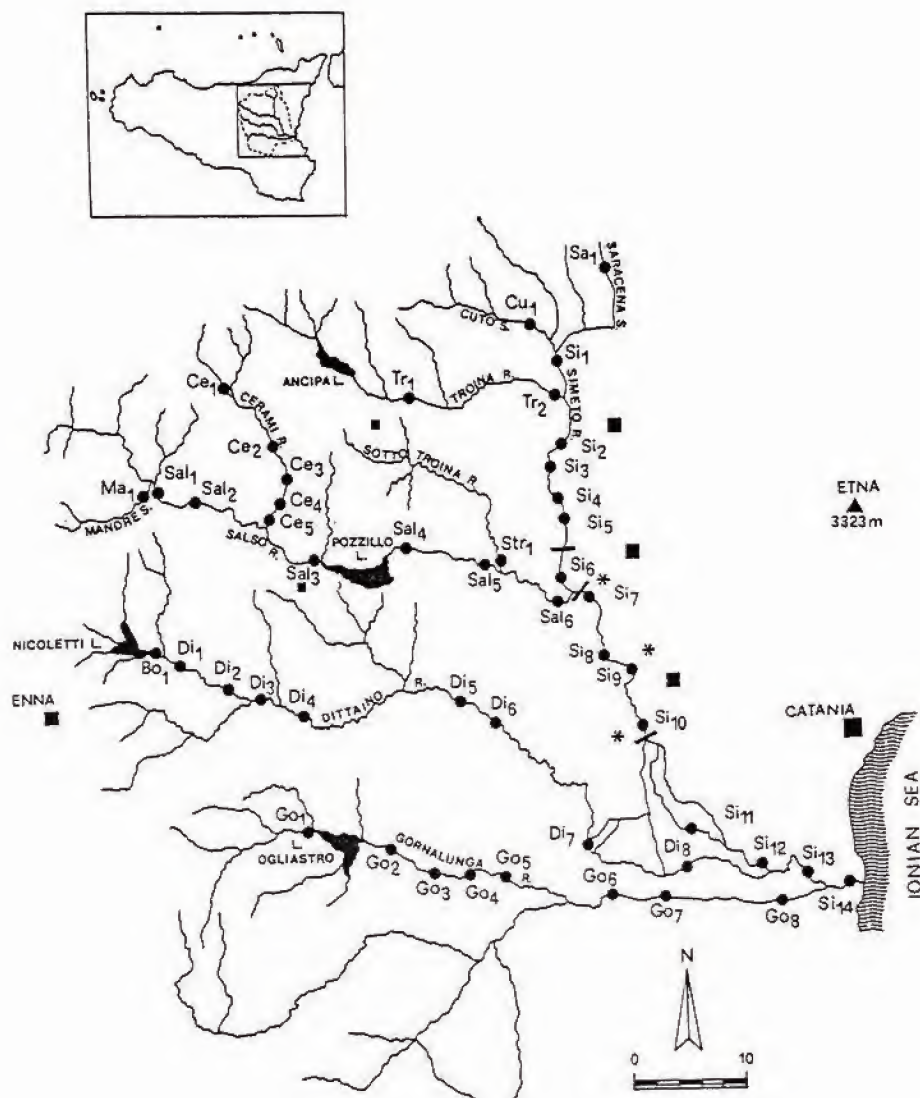


Fig. 1. - Simplified catchment area of the Simeto basin with the stations examined (black disks) since 1977 up to now. The barrages (-), the hydro-electric power plants (*) and the more important towns (■) are indicated. For abbreviations see table I. L.= Lake; R.= River; S.= Stream.

RESULTS

In the last fifteen years we have noticed the presence of 19 fish species belonging to 13 families. The fifteen years are divided into quinquennia and the presence of the species

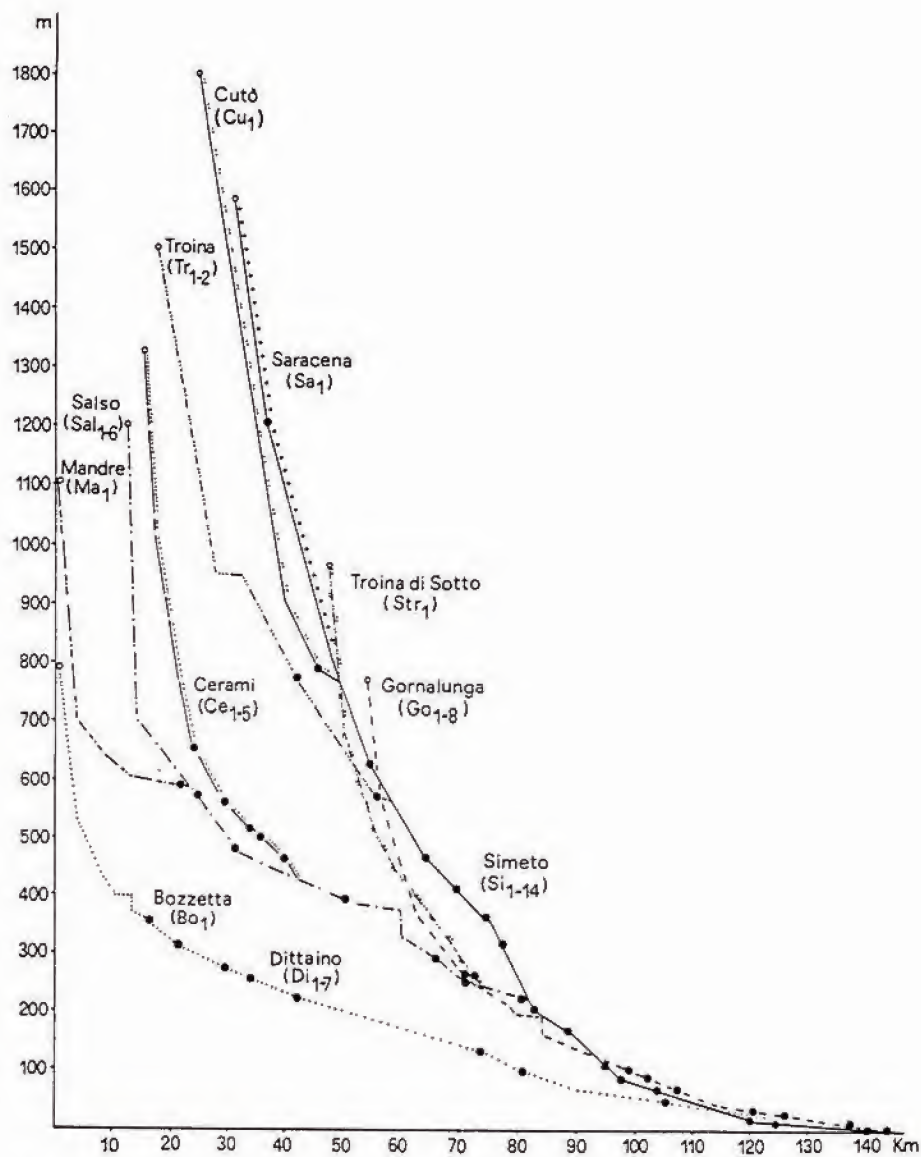


Fig. 2. - Localization of the stations examined (dark spots) along the longitudinal profiles of the Simeto river and its tributaries. Abscissa = distance from the source; ordinate = altitude. For abbreviations see table I.

during a quinquennium is indicated in brackets as follows: (1) 1977-1982, (2) 1983-1987, (3) 1988-1992 (for station name abbreviation see table I). The distribution of the 19 fish species noticed is indicated in figure 3.

Fam. Anguillidae

Anguilla anguilla (Linnaeus, 1758). - Collecting localities: (1) SI 8, SI 9, SI 10, SI 14; (3) SI 14.- Material examined: Simeto river, 17 specimens.

Fam. Engraulidae

Engraulis encrasicolus (Linnaeus, 1758). - Coll. loc.: (1), (3) SI 14. - Simeto river, 1 spm.

Tortonese (1970) states that the coastal form living in the gulf of Catania and at the mouth of the Simeto river has a smaller size than the pelagic form.

Fam. Cyprinidae

Rutilus rubilio (Bonaparte, 1837). - Coll. loc.: (2) CE 1, CE 5, SAL 3; (3) SI 6, SI 7, SI 8, SI 9, SI 11, CE 1, CE 3, CE 4, CE 5, SAL 3, SAL 6, DI 1, GO 1, GO 5, GO 8. - Simeto river, 6 spms; Salso r., 3 spms; Cerami r., 62 spms; Dittaino r., 1 spm; Gornalunga r., 3 spms.

We have recently recorded the presence of *R. rubilio* in Sicily (Tigano and Ferrito, 1986, 1988) and we have noticed that the values of some morphometric and meristic characters of the Sicilian populations are different from those of specimens of comparable size belonging to peninsular populations (Bianco and Taraborelli, 1985). *R. rubilio* spread very rapidly in the Simeto basin and now it is the only species present in some stations where, before, many other species were present (Tigano, 1983).

Tinca tinca (Linnaeus, 1758). - Coll. loc.: (1) SI 7, SI 8, SI 9, SI 10, SI 11; (3) SI 2, SI 3, SI 5. - Simeto river, 19 spms.

Sommani (1969) and Gandolfi *et al.* (1991) state that the Sicilian populations of *T. tinca* derive from specimens introduced into Sicily in the past. *T. tinca* was very abundant in the Simeto river in the past (Gemmellaro, 1864; Sicher, 1898) and Tigano (1983) recorded its presence in the middle and lower Simeto; now *T. tinca* is present only in the upper Simeto.

Cyprinus carpio Linnaeus, 1758. - Coll. loc.: (1) SI 9, SI 11; (3) SI 9, SAL 6. - Simeto river, 12 spms; Salso river, 1 spm.

All the specimens examined belong to the variety "carpa a specchi" or "di Galizia".

Sommani (1969) states that *C. carpio* was introduced into Sicily at the beginning of the 20th century, but formerly Rafinesque (1810) cited the species among the freshwater fishes of Sicily. We found *C. carpio* sporadically in the Simeto basin.

Carassius auratus (Linnaeus, 1758). - Coll. loc.: (1) SI 7, SI 9, SI 10, SI 11; (3) SI 2, SI 3, SI 4, SI 5, SI 8, SI 10, SAL 6, DI 1, GO 8. - Simeto river, 13 spms; Salso river, 1 spm; Dittaino river 1 spm; Gornalunga river, 1 spm.

The presence of *C. auratus* in Sicily was recorded from the beginning of the 19th century by Rafinesque (1810). Now the species is quite usual in the Simeto basin.

Fam. Ictaluridae

Ictalurus sp. - Coll. loc.: (3) SI 8, SI 9.

The species was signalized only by local fishermen.

Fam. Esocidae

Esox lucius Linnaeus, 1758. - Coll. loc.: (3) SI 8, SI 9.

The species was signalized only by local fishermen.

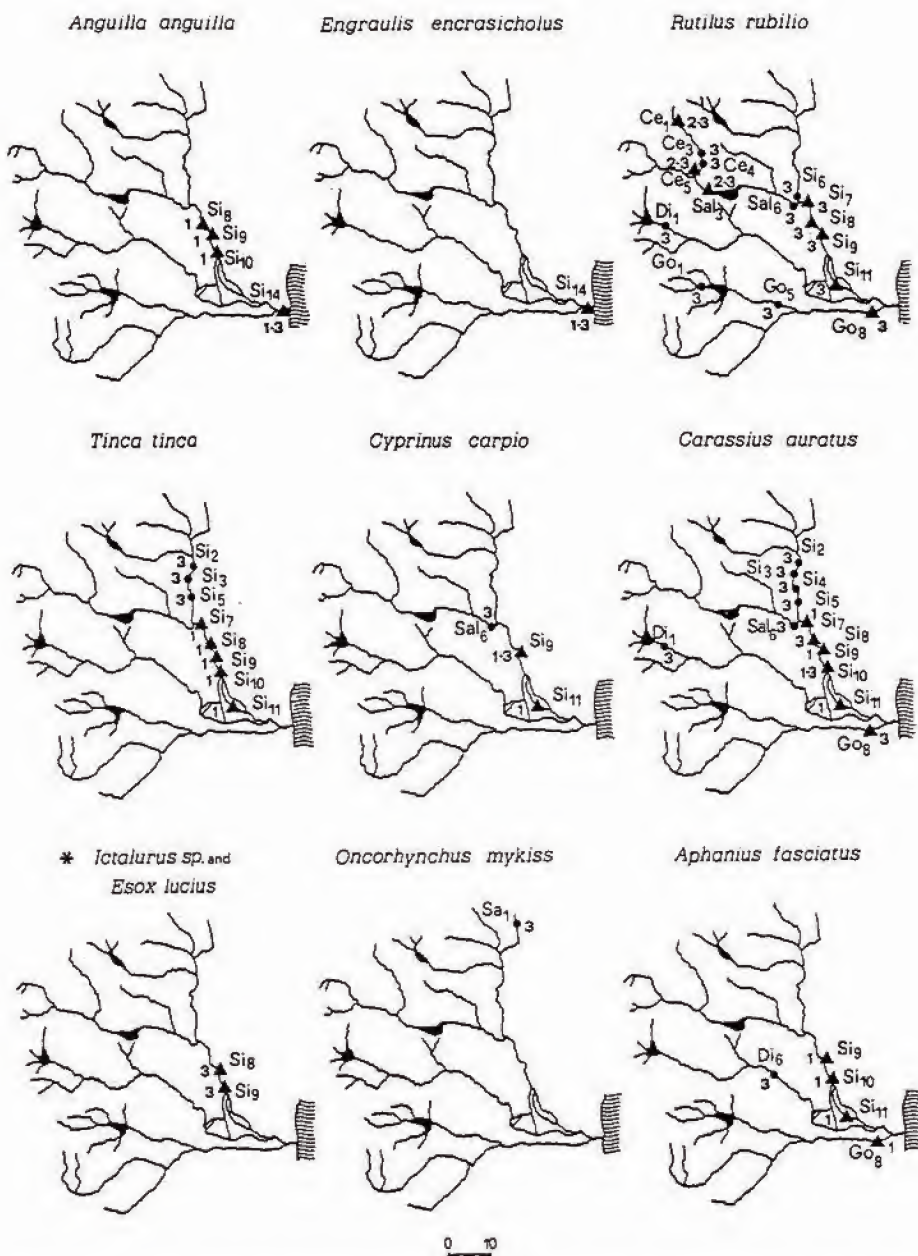


Fig. 3. - Distribution of the fish species in the Simeto basin. The stations examined since 1977 up to now are reported: the dark triangles indicate those examined in two different quinquennia; dark spots indicate the remaining stations. The numerals indicate the quinquennium in which the species was found: (1) 1977-1981; (2) 1982-1986; (3) 1983-1992. For abbreviations see table I. The artificial lakes are blackened. Asterisk = species signaled only by fishermen.

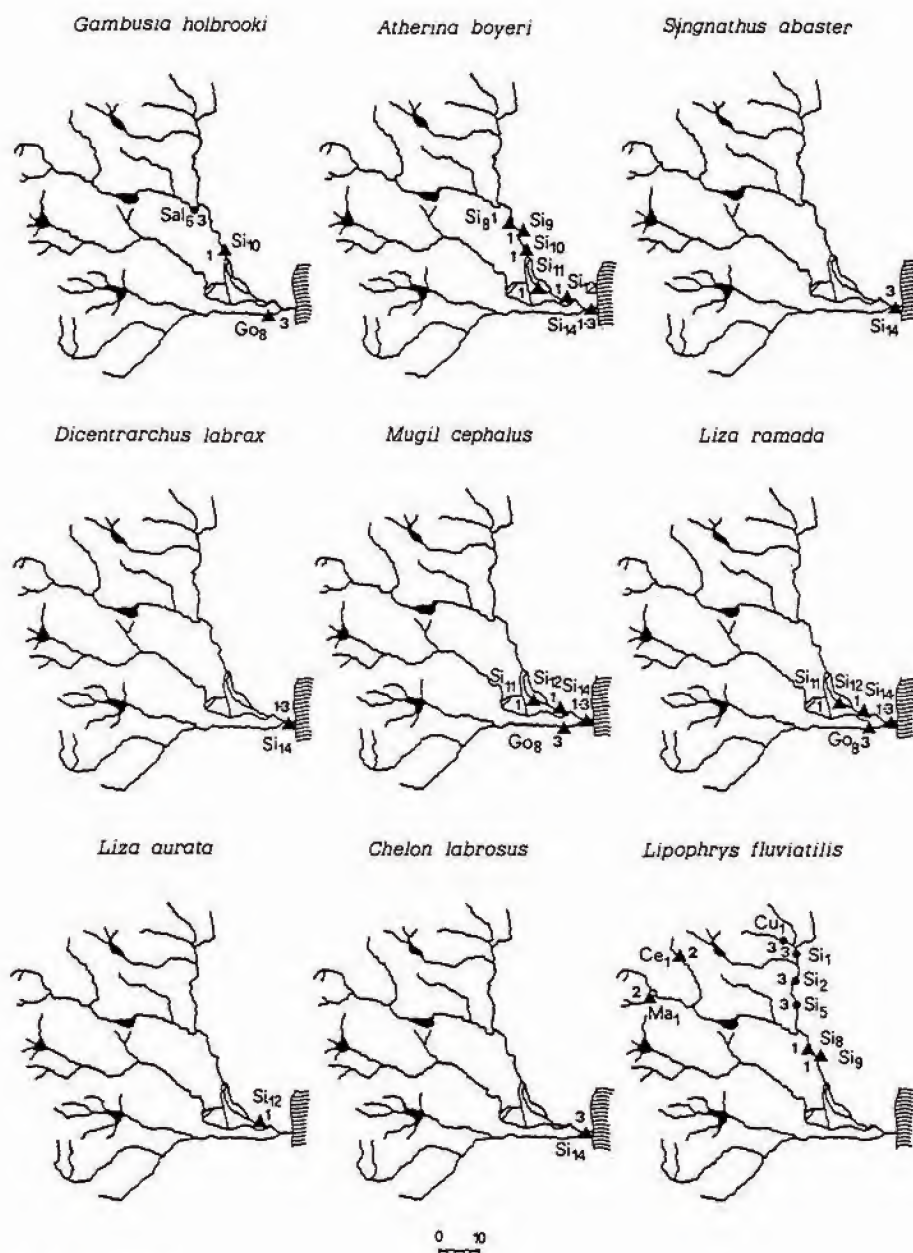


Fig. 3. - (continued).

Fam. Salmonidae

Oncorhynchus mykiss (Walbaum, 1792). - Coll. loc.: (3) SA 1. - Saracena stream, 1 spm.

This species was introduced into the Simeto basin a few years ago and some local

fishermen indicated that it is present, with few specimens, in the Saracena stream. It seems that this species, introduced in Europe around 1880, cannot normally reproduce in Italy (Gandolfi *et al.*, 1991).

Fam. Cyprinodontidae

Aphanius fasciatus Nardo, 1827. - Coll. loc.: (1) SI 9, SI 10, SI 11, GO 8; (3) DI 6. - Simeto river, 137 spms; Dittaino river, 5 spms; Gornalunga river, 20 spms.

The study of some osteological characters in *A. fasciatus* populations from several Italian peninsular and insular localities, including the population of the Simeto river recorded by Tigano (1983), showed the presence of a considerable polymorphism (Tigano and Parenti, 1988; Tigano, 1991).

Fam. Poeciliidae

Gambusia holbrooki Girard, 1859. - Coll. loc.: (1) SI 10, (3) SAL 6, GO 8. Simeto river, 9 spms; Salso river, 1 spm; Gornalunga river, 5 spms.

Fam. Atherinidae

Atherina boyeri Risso, 1810. - Coll. loc.: (1) SI 8, SI 9, SI 10, SI 11, SI 12, SI 14; (3) SI 14. - Simeto river, 22 spms.

Fam. Syngnathidae

Syngnathus abaster Risso, 1810. - Coll. loc.: (3) SI 14. Simeto river, 5 spms.

Doderlein (1878-79) noticed the presence of *S. abaster* in Sicilian waters but we report, for the first time, the presence of the species at the mouth of the Simeto river.

Fam. Moronidae

Dicentrarchus labrax (Linnaeus, 1758). - Coll. loc.: (1) SI 14; (3) SI 14. - Simeto river, 4 spms.

Fam. Mugilidae

Mugil cephalus Linnaeus, 1758. - Coll. loc.: (1) SI 11, SI 12, SI 14; (3) SI 14, GO 8. - Simeto river, 8 spms; Gornalunga river, 1 spm.

Liza ramada (Risso, 1826). - Coll. loc.: (1) SI 11, SI 12, SI 14; (3) SI 14, GO 8. - Simeto river, 18 spms; Gornalunga river, 1 spm.

Liza aurata (Risso, 1810). - Coll. loc.: (1) SI 12. - Simeto river, 1 spm.

Chelon labrosus (Risso, 1826). - Coll. loc.: (3) SI 14. Simeto river, 7 spms.

We notice, for the first time, the presence of *C. labrosus* at the mouth of the Simeto river.

Fam. Blenniidae

Lipophrys fluviatilis (Asso, 1801). - Coll. loc.: (1) SI 8, SI 9; (2) CE 1, MA 1; (3) CU 1, SI 1, SI 2, SI 5. - Cutò stream, 2 spms; Simeto river, 21 spms; Cerami river, 2 spms; Mandre stream, 2 spms.

Comparison between the distribution of the fish fauna in the last quinquennium and that existing in past years (Tigano, 1983) shows that:

Three species have been introduced to the basin: *Rutilus rubilio*, *Esox lucius* and *Ictalurus sp.*

One species has disappeared: *Aphanius fasciatus*; and others have sensibly reduced their distribution in the basin: *Lipophrys fluviatilis*, *Tinca tinca* and *Cyprinus carpio*.

The euryaline species, diadromous or not, are present only at the mouth of the Simeto river: *Anguilla anguilla*, *Atherina boyeri*, *Mugil cephalus* and *Liza ramada*. In the past these species were found far from the mouth (Table II).

DISCUSSION

The Italian southern peninsula together with Sicily and Sardinia do not correspond to a particular ichthyogeographic district because they have a very poor fish fauna. Sicily particularly is lacking in endemic species and in autochthonous primary freshwater fishes (Bianco, 1982; Gandolfi *et al.*, 1991). The paleogeographic and paleoclimatic events which occurred in southern Europe, as from the Tertiary, could certainly explain this lack of species (Banarescu, 1975). Therefore the existing primary freshwater fish populations have been introduced to Sicily in more or less recent times.

As regards the fish fauna of the Simeto basin, we can put the species present in the following categories of freshwater fishes: 1) Primary freshwater fishes: *Rutilus rubilio*, *Tinca tinca*, *Cyprinus carpio*, *Carassius auratus*; 2) Secondary division freshwater fishes: *Aphanius fasciatus*, *Gambusia affinis*; 3) Diadromous freshwater fishes: *Anguilla anguilla*; 4) Complementary freshwater: *Lipophrys fluviatilis*; 5) Sporadic freshwater fishes: *Engraulis encrasicolus*, *Atherina boyeri*, *Syngnathus abaster*, *Dicentrarchus labrax*, *Mugil cephalus*, *Liza aurata*, *L. ramada*, *Chelon labrosus*.

It seems to be rather doubtful to differentiate a zonation, based on the longitudinal succession of fish communities, in the rivers of the Simeto basin. Any such attempt must be done with prudence. Sommani (1952) and Zerunian (1982) state that it is difficult to fit the longitudinal zonation, developed by Huet (1949) for the rivers of central and western Europe, respectively to Sicilian rivers and to central and southern rivers of the Italian peninsula. Our results and those in the literature (Tigano, 1983), in accordance with the zonation of Zerunian (1982), allow us to define along the Simeto river only two zones: the limnophilic Cyprinids zone and the brackish water zone. The presence of *Oncorhynchus mykiss* in the Saracena stream could lead us to consider also a third zone, that of the trout; but this is impossible because this species, introduced in the Saracena stream for the last few years, cannot normally reproduce (Gandolfi *et al.*, 1991).

From these considerations about the present distribution of the fish populations in the Simeto basin, we can conclude that the fish fauna, in the last fifteen years, met with great alterations and a great impoverishment; this is particularly evident in the tract of the Simeto river between the confluence with the Salso river and the mouth (Si 7-14) (Table II). In this tract, where the stations were examined in two different quinquennia, if we exclude the station near the mouth, where many euryaline species are present, we found now only three species: *R. rubilio*, *Cyprinus carpio* and *Carassius auratus*; in the same tract Tigano (1983) noticed the presence of eleven species (Table II).

The rarefaction seems very alarming especially of the indigenous species of the Mediterranean area such as *Aphanius fasciatus* and *Lipophrys fluviatilis*, the great scientific interest of which has been recently noticed (Almaça, 1988). The disappearance of the population of *A. fasciatus* from the Simeto river is particularly regrettable because the

Table II. - Fish species noticed during the last fifteen years along the lower Simeto and some tributaries. Only the 13 stations examined in two different quinquennia are reported. a: absent, p: present; a dash indicates that the species has not been found. The numerals indicate the quinquennium in which the species was found: (1) 1977-1981; (2) 1982-1986; (3) 1983-1992. For abbreviations see table 1.

Species	Sl7	Sl8	Sl9	Sl10	Sl11	Sl12	Sl14	Ma1	Sal3
<i>Anguilla anguilla</i>	-	p (1), a (3)	p (1), a (3)	p (1), a (3)	-	-	p (1), p (3)	-	-
<i>Engraulis encrasicolus</i>	-	-	-	-	-	-	p (1), p (3)	-	-
<i>Rutilus rubilio</i>	a (1), p (3)	a (1), p (3)	a (1), p (3)	-	a (1), p (3)	-	-	-	-
<i>Tinca tinca</i>	p (1), a (3)	p (1), a (3)	p (1), a (3)	p (1), a (3)	p (1), a (3)	-	-	-	p (2), p (3)
<i>Cyprinus carpio</i>	-	-	p (1), p (3)	-	p (1), a (3)	-	-	-	-
<i>Carassius auratus</i>	p (1), a (3)	a (1), p (3)	p (1), a (3)	p (1), p (3)	p (1), a (3)	-	-	-	-
<i>Ictalurus sp.</i>	-	a (1), p (3)	a (1), p (3)	-	-	-	-	-	-
<i>Esox lucius</i>	-	a (1), p (3)	a (1), p (3)	-	-	-	-	-	-
<i>Aphanius fasciatus</i>	-	-	p (1), a (3)	p (1), a (3)	p (1), a (3)	-	-	-	-
<i>Gambusia holbrooki</i>	-	-	-	p (1), a (3)	-	-	-	-	-
<i>Atherina boyeri</i>	-	p (1), a (3)	p (1), a (3)	p (1), a (3)	p (1), a (3)	p (1), a (3)	p (1), a (3)	-	-
<i>Syngnathus abaster</i>	-	-	-	-	-	-	p (3)	-	-
<i>Dicentrarchus labrax</i>	-	-	-	-	-	-	p (1), p (3)	-	-
<i>Mugil cephalus</i>	-	-	-	-	p (1), a (3)	p (1), a (3)	p (1), p (3)	-	-
<i>Liza ramada</i>	-	-	-	-	p (1), a (3)	p (1), a (3)	p (1), p (3)	-	-
<i>Liza aurata</i>	-	-	-	-	-	p (1), a (3)	-	-	-
<i>Chelon labrosus</i>	-	-	-	-	-	-	p (3)	-	-
<i>Lipophrys fluviatilis</i>	-	p (1), a (3)	p (1), a (3)	-	-	-	-	p (2), a (3)	-

Italian populations of this species present a sensible polymorphism, especially for several characters of the skull (Tigano and Parenti, 1988; Tigano, 1989; Tigano, 1991; Parenti and Tigano, 1993), and also for morphological, morphometric and meristic characters (Tigano, 1982; Tigano and Ferrito, 1983-84). They are very interesting for research into microevolutionary processes, as already noticed by Villwock (1982) and Comparini *et al.* (1983-1984), which indicate the presence of different stages of "species in statu nascendi" within populations of *Aphanius* species.

The reasons of this impoverishment are certainly derived from the effects of the human impact. Along the Simeto river several dams are present (the latest was built, in the lower course, in 1985) that need fish pass. *Anguilla anguilla* and the euryaline Mugilidae and Atherinidae species cannot now reach the upstream stations as formerly noticed by Tigano (1983). Many hydraulic engineering works are present in the Simeto basin. The increased flow-variability is a consequence of the hydroelectric, industrial and irrigation exploitation of the Simeto basin rivers. The excessive water abstraction now causes the decrease of the discharge or even the drying up of long tracts of the river, especially in the dry season. In these tracts the structure of the fluvial biocoenoses is much modified and very poor (Ferrito, 1990; 1994). Water pollution is also a cause of habitat deterioration, and that of the Simeto river has been already noticed by previous workers (Maggiore *et al.*, 1983).

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